

## HOME NETWORK SYSTEM

TECHNICAL FIELD

The present invention relates to a home network system, and more particularly to, a home network system which can disconnect a home appliance from the home network system, by resetting an address of the home appliance by deleting home appliance related information.

BACKGROUND ART

Home automation for automatically controlling home appliances at home or remotely has almost reached a commercial use stage. At its early stage, the home automation separately controlled each home appliance by using a telephone or infrared rays, and did not connect the home appliances one another. However, there has been suggested a method for building a network of home appliances by using a communication means, and collectively managing the network by using a controller.

Fig. 1 is a structure view illustrating a general home network system. Referring to Fig. 1, a home network connects various digital home appliances so that a user can always enjoy convenient, safe and economic life services inside or outside the house.

As factors of the advent of the home network, refrigerators or washing machines called white home appliances have been gradually digitalized due to development of digital signal processing techniques, and new information home appliances have been made due to rapid development of home appliance operating system techniques and high speed multimedia communication techniques.

Here, an IT network is built to exchange data between a personal computer and peripheral devices or provide internet services, and an AV network is built between home appliances using audio or video information. In addition, a living network is built to simply control home appliances, such as home automation or remote meter reading, and may be comprised of a refrigerator, washing machine, microwave oven, electric lamp, gas alarm, air conditioner and telephone.

The home network system includes a master device which is a home appliance for controlling an operation of the other home appliances or monitoring a status thereof, and a slave device which is a home appliance having a function of responding to the request of the master device and a function of notifying a status change according to properties of the home appliances or other factors. Here, the home appliances (or new devices) include home appliances for the living network service such as a washing machine and a refrigerator as well as home appliances for the IT network service and the AV network service.

Fig. 2 is a structure view illustrating a general home network system at home. As illustrated in Fig. 2, the home network system 1 includes at least one master device 10 and slave devices 1 to 4 20, 22, 24 and 26 connected through a bus network 28.

As shown in Fig. 3, the master device 10 sets addresses for distinguishing the slave devices 1 to 4 20, 22, 24 and 26 according to a predetermined method.

Fig. 3 is a table showing one example of a home network list. As depicted in Fig. 3, the home network list is formed and stored by the master device 10, and has information of addresses of the devices connected to the home network system 1.

A process for disconnecting the slave device 4 26 from the home network system 1 and migrating the slave device 4 26 to another area or home will now be explained. In the case that the user disconnects the slave device 4 26 from the bus

network 28 and migrates the slave device 4 26, the master device 10 cannot decide whether the slave device 4 26 is not operated due to power off or migration. Accordingly, the master device 10 continuously stores the home network list of Fig. 3, which wastefully spends an address which can be assigned for configuration of a new device in the home network system 1. Moreover, the master device 10 may generate and transmit a control command for the non-connected devices, to inefficiently use network resources.

As another example, the slave device 4 26 may need to be logically disconnected from the bus network 28 not to receive any data in the home network system 1, instead of being physically disconnected from the bus network 28. In order for the slave device 4 26 to execute a control command without interferences of other devices, or in order to reduce a network traffic when a large number of devices are connected to the bus network 28, the slave device 4 26 needs to be logically disconnected, namely, data communication needs to be blocked, which is not achieved by the conventional arts.

#### DISCLOSURE OF THE INVENTION

An object of the present invention is to provide a home network system which can efficiently use storage spaces and address resources by performing a process for deleting information of a device disconnected from the home network system.

Another object of the present invention is to provide a home network system which can prevent system confusions by performing a process for deleting information of the home network system stored in a device disconnected from the home network system and migrated to another home network system.

Yet another object of the present invention is to provide a home network

system which can efficiently connect a disconnected device to another home network system by restoring option values set in the disconnected device according to a status of the home network system to original values.

Yet another object of the present invention is to provide a home network  
5 system which can reduce a network traffic and allow a predetermined device to execute a command without interferences of other devices, by physically and/or logically disconnecting the device from the home network system.

In order to achieve the above-described objects of the invention, there is provided a home network system including: a master device for transmitting a  
10 deletion request message to a home appliance connected to the home network system in order to disconnect the home appliance, receiving a deletion ACK response message from the home appliance, and deleting home appliance related information; and a home appliance for receiving the deletion request message from the master device, transmitting the deletion ACK response message, and deleting  
15 home network system related information.

Preferably, the deletion request message includes a logical address for the home appliance.

Preferably, the home network system related information includes at least a logical address assigned by the master device, and the home appliance changes  
20 the logical address to a previously-stored initial logical address and stores the changed address.

Preferably, the master device further includes a display device for displaying deletion of the home appliance related information.

According to another aspect of the invention, a disconnection method of a  
25 home appliance in a home network system including at least one master device and at least one home appliance includes the steps of: transmitting, at the master

device, a deletion request message to the home appliance in order to disconnect the home appliance from the home network system; transmitting, at the home appliance, a deletion ACK response message to the master device; deleting, at the home appliance, home network system related information; and deleting, at the  
5 master device, home appliance related information.

Preferably, the deletion request message includes a logical address for the home appliance.

Preferably, the home network system related information includes at least a logical address assigned by the master device, and the disconnection method  
10 further includes a step for changing, at the home appliance, the logical address to a previously-stored initial logical address and storing the changed address.

Preferably, the disconnection method further includes a step for displaying, at the master device, deletion of the home appliance related information through a display device.

15 According to another aspect of the invention, a program storage medium stores a computer readable program which disconnects a home appliance from a home network system including at least one master device and at least one home appliance, and which includes the steps of: transmitting, at the master device, a deletion request message to the home appliance in order to disconnect the home  
20 appliance from the home network system; transmitting, at the home appliance, a deletion ACK response message to the master device; deleting, at the home appliance, home network system related information; and deleting, at the master device, home appliance related information.

Preferably, the deletion request message includes a logical address for the  
25 home appliance.

Preferably, the home network system related information includes at least a

logical address assigned by the master device, and the program further includes a step for changing, at the home appliance, the logical address to an initial logical address.

Preferably, the program further includes a step for displaying, at the master  
5 device, deletion of the home appliance related information through a display device.

### BRIEF DESCRIPTION OF THE DRAWINGS

- Fig. 1 is a structure view illustrating a general home network system;  
10 Fig. 2 is a structure view illustrating a home network system at home;  
Fig. 3 is a table showing one example of a home network list;  
Fig. 4 is a structure view illustrating a home network system in accordance with the present invention;  
Fig. 5A is a structure view illustrating a master device of Fig. 4;  
15 Fig. 5B is a structure view illustrating a slave device of Fig. 4;  
Figs. 6A to 6C are structure views illustrating address systems used in the home network system in accordance with the present invention;  
Fig. 7 is a flowchart showing a disconnection method of the home network system in accordance with the present invention; and  
20 Figs. 8A and 8B are tables showing examples of the home network list in accordance with the disconnection method of Fig. 7.

### BEST MODE FOR CARRYING OUT THE INVENTION

A home network system in accordance with the present invention will now  
25 be described in detail with reference to the accompanying drawings.

Fig. 4 is a structure view illustrating the home network system in

accordance with the present invention. Referring to Fig. 4, the home network system 100 includes at least one master device 50 and slave devices 60, 70 and 80 connected through a bus network 90. In addition, the home network system 100 further includes a gateway 30 for access to an external internet, and a network manager 40 connected to the gateway 30, for providing an internet service and performing environment setting and resetting functions of home appliances of the home network system 100.

Here, the master device 50 performs the same functions as the general master device, and the network manager 40 performs similar functions to the master device 50 except for the internet service. For conveniences' shake, there are presumed that the network manager 40 performs functions such as a bridge for the internet service, and that only one master device 50 exists in the home network system 100.

The bus network 90 can be a wire medium such as a specially-installed line, or a previously-installed power line or telephone line, or a wireless transmission medium. However, still referring to Fig. 4, the home network system 100 composes a closed network for connecting home appliances of one house through a wire or wireless transmission medium. At this time, the closed network includes a physically-connected but logically-divided network.

Fig. 5A is a structure view illustrating the master device of Fig. 4. As shown in Fig. 5A, the master device 50 includes an interface means 52 for access to at least the bus network 90, a memory 54 for storing product information and product address information (including home network list) of the slave devices 60, 70 and 80, a display means 56 for displaying information (for example, home network list) to the user, and a control means 58 for controlling the interface means 52, the memory 54 and the display means 56.

The network manager 40 further includes an interface means (not shown) for access to the gateway 30.

Here, when the information of the slave devices 60, 70 and 80 stored in the memory 54 includes functional properties and performance of each product, it also includes addresses for distinguishing the devices in the home network system 100, which will later be explained.

Fig. 5B is a structure view illustrating the slave device of Fig. 4. As depicted in Fig. 5B, the slave device 60 includes an interface means 62 for access to the bus network 90, a memory 64 for storing product information and address information of the slave device 60, and a control means 66 for controlling the interface means 62 and the memory 64.

Figs. 6A to 6C are structure views illustrating address systems used in the home network system in accordance with the present invention.

Fig. 6A shows a structure of an address field used in the home network system 100. As illustrated in Fig. 6A, a product code is a unique value for distinguishing a basic function of a product, and a non-changeable physical address assigned to the product in shipment. Same kind of products have the same fixed address. A device code is a logical address used for distinguishing the products having the same product code. An area code is a logical address assigned according to the installed area at home.

Fig. 6B shows a detailed structure of the address field of Fig. 6A. As shown in Fig. 6B, MSB of the fixed address field is used as a flag, '0' implies the device code and '1' implies the area code. Therefore, the usage of logical address for the device code and the area code can be switched by setting the value of MSB in the whole address fields. In addition, when all bits in each sub-field are set to '1', a group address is assigned. For example, when a product code of a refrigerator is



'0x01', '0x01FF' indicates a group address of refrigerators, and '0x81XX (X is an unspecific number)' indicates a group address of refrigerators having the same area code.

The device code can be automatically set in each slave device by the master device 50, and the area code can be automatically set by the master device 50. However, the area code are mostly set by the user due to technical problems. Here, the logical code implies the device code. The area code is additionally used in special cases.

Fig. 6C shows examples of product codes and address ranges of each product. In the address ranges, '0xXX00' implies initial logical addresses of each product, '0xXXFF' implies group addresses of each product as described above, and '0xXX01~0xXXFE' are logical addresses assigned to each master device and slave device in the home network system 100.

The product codes and the initial logical addresses are contained and stored in the memories 64 of the slave devices 60, 70 and 80 in shipment. In addition, the product codes and address ranges of each product are stored in the memory 54 of the master device 50. The logical addresses of each address range are assigned to devices newly connected to the home network system 100 by the control means 58.

The master device 50 registers the addresses (product codes and logical addresses) which are unique values for distinguishing the slave devices 60, 70 and 80 connected to the home network system 100 in the home network list by using the address systems, and stores the home network list in the memory 54. The slave devices 60, 70 and 80 store the addresses containing the logical addresses set by the master device 50 and the previously-stored product codes in the memory 64, confirm an address of a message receiver, and receive or remove the

message.

After the slave devices 60, 70 and 80 are connected to the home network system 100, the slave devices 60, 70 and 80 transmit alive event messages for an alive notification period in order to notify their status to the master device 50. The  
5 alive notification period is set in shipment according to predetermined standards (for example, properties of product), stored in the memory 64, and read by the control means 66, to transmit the alive event messages. The master device 50 receiving the alive event messages adjusts the alive notification period in each slave device 60, 70 and 80 according to a status of the home network system 100  
10 or bus network 90. In this case, the master device 50 transmits new alive notification periods to the slave devices 60, 70 and 80, and the slave devices 60, 70 and 80 store the new alive notification periods in the memory 64.

Fig. 7 is a flowchart showing a disconnection method of the home network system in accordance with the present invention. The disconnection method  
15 includes a step (S70) for transmitting a deletion request message, a step (S72) for transmitting a deletion ACK response message, and a step (S74) for deleting information.

In detail, in S70, the control means 58 of the master device 50 reads addresses of the slave devices (or devices) 60, 70 or 80 which it intends to delete  
20 from the memory 54, and transmits the deletion request messages containing the addresses and deletion command codes to the slave devices 60, 70 and 80 through the bus network 90.

In S72, the control means 66 of the slave devices 60, 70 and 80 receive the deletion request messages, compare the contained addresses with the addresses  
25 stored in the memory 64, confirm whether the deletion request messages relate to themselves, and transmit deletion ACK response messages to the master device

50.

In S74, the control means 66 of the slave devices 60, 70 and 80 restore logical addresses previously set by the master device 50 to initial logical addresses, and store the initial logical addresses. In addition, when the option values such as the alive notification period are changed by the master device 50, the control means 66 of the slave devices 60, 70 and 80 restore the option values to initial option values, and store the initial option values. On the other hand, the master device 50 receiving the deletion ACK response messages deletes information (product information) of the slave devices 60, 70 and 80 which it intends to delete, and empties the addresses (logical addresses, namely device addresses and area addresses) of the slave devices 60, 70 and 80 to be assigned to other slave devices. Thereafter, the control means 58 of the master device 50 informs the user through the display means 56 that the slave devices 60, 70 and 80 have been deleted and disconnected.

In accordance with the disconnection method, the master device 50 and the slave devices 60, 70 and 80 do not have each other's information, so that the user can freely disconnect the slave devices 60, 70 and 80 from the bus network 90 and configure them in another home network system.

The configuration method can be made in the form of a program, and stored in a storage means of the master device and/or slave device of the home network system.

Figs. 8A and 8B are tables showing examples of the home network list in accordance with the disconnection method of Fig. 7.

The home network list of Fig. 8A shows information of the home network system 100 before the application of the disconnection method. A master device, a refrigerator, air conditioners 1 to 4 and a microwave oven compose the home

network system 100.

The home network list of Fig. 8B shows a state where the master device has disconnected the air conditioner 2. An address (0x0203) is empty due to disconnection of the air conditioner 2. Accordingly, when an air conditioner is newly  
5 connected to and configured in the home network system 100, the address (0x0203) can be assigned to the air conditioner.

The following Table 1 shows message protocols used by the home network system of the invention. As shown in Table 1, the message protocols include messages used by the home appliance and the master device of the home  
10 network system.

[Table 1]

Messages	Command code	Arguments	
		Name	Type
Deletion request message	0x1B	Logical code (device code)	Unsigned char
		Description: master device can remove the home appliance related information in home network list by sending this message.	
Deletion ACK response message	0x0B	ACK	Unsigned char
		Description: when the home appliance receives deletion request message, it sends response message then clears all network related values such as logical address and $T_{\text{alive}}$ (alive notification period).	

Although the preferred embodiments of the present invention have been described, it is understood that the present invention should not be limited to these  
15 preferred embodiments but various changes and modifications can be made by

one skilled in the art within the spirit and scope of the present invention as hereinafter claimed.